REMARKS/ARGUMENTS

Thorough examination and careful review of the application by the Examiner is noted and appreciated.

The specification was amended to identify serial numbers, filing dates and prosecution status of each cross-related application.

The examiner has rejected claims 1-20.

By way of the foregoing amendments, claims 1, 4, 7, 8, 11, 13-15, 18, and 20 have been amended, claim 2 has been cancelled without prejudice, and claims 21-23 are newly added. Accordingly, upon entry of this Response, Claims 1, and 3-23 are pending.

Lexicography in the Title, Specification, and Claims

Applicant has amended the title, specification, and claims 1, 7, 8, 14, and 15 to clearly define applicant's invention of "detecting demagnetization of permanent magnets" in light of applicant's originally filed application.

As applicant is entitled to be "his or her own lexicographer", see Multiform Desiccants Inc. v. Medzam Ltd., 133 F.3d 1473, 1477, 45 USPQ2d 1429, 1432 (Fed. Cir. 1998), the term "identification" as used in the specification means "detection". Pending application, Title, page 1, lines 1-2 ("**IDENTIFICATION** DUE TO DEMAGNETIZATION FOR A MOTOR IN AN ELECTRIC OR PARTIALLY ELECTRIC MOTOR VEHICLE"), and see also, Pending Application, page 6, lines 14-17 ("Accordingly, an object of the present invention is to provide a **detection method** for determining the specific location of a degraded (demagnetized) permanent magnet for a motor of an electric or a hybrid electric vehicle (HEV).").

Additionally, the term "**demagnetization**" as used within applicant's originally submitted application means "." See Pending Application, page 6, lines 14-17 ("Accordingly, an

object of the present invention is to provide a detection method for determining the specific location of **a degraded (demagnetized)** permanent magnet for a motor of an electric or a hybrid electric vehicle (HEV).").

Additionally, the term "faulty" as used within applicant's originally submitted application means "failing". See Pending application, page 16, lines 2-3 ("Based on the point of synchronization, **a failing or faulty** permanent magnet is identified."); see Pending application, page 16, lines 24-25 ("Based on the point of synchronization, **a failing or faulty** permanent magnet or set is identified); and see also, Pending Application, page 8, line 2-5 ("In particular, **the permanent magnets are configured such that a change in magnetic reluctance or magnetic strength is used to identify a faulty magnet**. A diagnostic code is set to alert others of the position of **the failing magnet** for replacement or other corrective action.").

The definition of "**failing**" in accordance with the Merriam-Webster's Collegiate® Dictionary, Eleventh Edition is defined as:

> **1 a : to lose strength** : **WEAKEN <her health was failing>**

Thus, a permanent magnet that is "failing" or "faulty" is a magnet that is "**weakening**" or "**losing its strength**" and thus, is becoming "demagnetized".

Additionally, the term "component" is used interchangeably in the specification to mean a "permanent magnet within a motor". See Pending application, page 7, line 23 through page 8, line 2. "The difference is analyzed to **determine if a component is faulty**. In particular, the permanent magnet induced voltage is a function of the relative

positions and locations of the permanent magnets in the motor. **This relationship is used to identify a faulty magnet.**"

Additionally, Pending application, page 8, line 18 through page 9, line 6 uses the terms "magnets" and "components" interchangeably as follows:

> "A difference between the first signal and the reference signal is analyzed to determine **a faulty component that is likely causing the difference.** In particular, the first signal and reference signal include points of synchronization that **relate to the position of potentially faulty components.** More specifically, the points of synchronization are **caused by a predetermined change in structure of the motor at a particular location relative to the location of the permanent magnets.** This change in structure results in a change in motor reluctance or magnet strength that is reflected in the first signal and the reference signal. Hence, **differences between the first signal and the reference signal are correlated to a position of a faulty component.**"

Thus, references in the Title, specification and claims relating to "**faulty component**" are now replaced with "**demagnetized permanent magnet**" to clarify that a "failing or faulty component" is a weakening permanent magnet or a "demagnetized permanent magnet".

The changes in the title, specification and claims do not introduce new matter but clarify matters shown and described in the application as filed. The foregoing amendments and following remarks are believed to be fully responsive to the Office Action mailed April 23, 2003 and render all currently pending claims at issue patentably distinct over the references cited by the Examiner. The foregoing amendments are taken in the interest of expediting prosecution and there is no intention of surrendering any range of equivalents to which Applicant would otherwise be entitled in view of the prior art.

Reconsideration and examination of this application is respectfully requested in light of the foregoing amendments and the following remarks.

EXAMINER'S OFFICE ACTION

In the April 23, 2003 Office Action referenced above, the Examiner:

requested that applicant's amend the specification to identify serial numbers, filing dates and prosecution status of each cross related application; and

rejected claims 1-20 under 35 USC § 102(b) as being anticipated by Abbot, U.S. Patent No. 3,947,764 (hereinafter "ABBOT"), Horvath et. al., U.S. Patent No. 5,751,132 (hereinafter "HORVATH") and Lebsock U.S. Patent No. 4,967,123 (hereinafter "LEBSOCK").

Request to Amend The Specification

Applicant has amended the specification to identify serial numbers, filing dates and prosecution status of each cross-related application as requested in the April 23, 2003 office action.

Claim Rejections Under 35 USC § 102(b)

Claims 1-20 are rejected under 35 USC § 102(b) as being anticipated by rejected claims 1-20 under 35 USC § 102(b) as being anticipated by ABBOT, HORVATH, and LEBSOCK.

The rejection of claims 1-20 under 35 USC § 102(b) based on ABBOT, HORVATH, and LEBSOCK is respectfully traversed.

ABBOTT teaches a device and method for measuring the terminal voltage of a motor (20) to determine if the magnets within the motor (20) have an overall high or low permanent magnetic charge. The ABBOTT reference measures the terminal

voltage of terminals (38 and 40) and then infers the overall strength of all of the magnets disposed in the motor (20). See ABBOTT, FIG. 2, and col. 2, lines 33-41 ("A motor having low permanent magnet charge also will have a low terminal voltage at the end of the second predetermined time interval during the constant current test portion").

Additionally, the motor (20) tested in the ABBOTT reference is tested using a fixed measuring apparatus (10) outside of a vehicle such as a dynamometer. See ABBOTT, FIG. 1 and col. 1 lines 16-36.

> "Although the method and apparatus of the invention is believed to be generally suitable for testing other DC motor types, it is particularly suitable for testing of DC motors of the permanent magnet type. Permanent magnet DC motors conventionally are tested with a dynamometer.
>
> In the high volume production testing of permanent magnet DC motors with a dynamometer, **a fixture is required to hold the motor securely in place and to maintain it in precise alignment with a torque coupler. The torque coupler connects the motor output shaft to a torque brake. The torque brake is used to apply a specific torque to the motor output shaft. Means must be provided for applying voltage to the motor terminals and for measuring such voltage.**"

ABBOTT, col. 1 lines 16-36

Thus, ABBOTT uses a test apparatus (10) to determine overall degradation or **demagnetization** of magnets in a motor (20). See ABBOTT, Col. 3, line 33-53.

Horvath teaches an electric motor monitoring circuit (10) having a phase monitoring circuit (25) and an insulation monitor (14) for monitoring insulation leakage (resistance) of **motor windings** prior to starting a motor. See HORVATH col. 3, lines 44-46, and col. 4, lines 23-27.

The phase monitoring circuit (25) has a phase detector (32) [incorrectly cited as 25 in line 46, see FIG. 2] is

connected through the conductors (29) to the three phase motor supply lines (12) and are connected to the phase detector (32), wherein supply lines (12) connect to a relay 13, and wherein the relay 13 connects to the motor (11). See HORVATH, FIG. 1-2, and col. 3, lines 46-48. The phase monitoring circuit (25) detects incorrect phasing or voltage sensed from motor supply lines (12) and will deactivate the electric motor whenever the phase monitor circuit (25) has detected incorrect phasing or voltage. See HORVATH col. 5 lines 2-5, and 37-40.

The insulation monitor is basically a "force a voltage sense a current" type. The 500 volt DC is applied to the motor windings and any leakage current that is sensed by a sensing line (15), as shown in FIG. 1 and 2, will be evaluated in the comparator (38). See HORVATH FIGS. 1-2, and HORVATH, col. 4, lines 31-34. Additionally, the insulation monitor (14) applies "500 volt DC to the line 16 to the motor windings . . . to evaluate the insulation resistance of the motor windings." HORVATH, col. 4, lines 48-52.

HORVATH does not determine permanent magnet induced voltage and thus, specific permanent magnet flux from measuring the phase voltage and insulation leakage of the motor (11). See HORVATH, col. 5, lines 32-39. The electric motor monitoring circuit(10) for monitoring a circuit has been provided which will deactivate the electric motor (11) before machine starts operating. Whenever the electric motor monitoring circuit(10) has detected an insulation leakage of the electric motor windings of a predetermined level and will deactivate the electric motor (11) whenever a three phase monitor circuit has detected incorrect phasing or voltage. See HORVATH, col. 5, lines 32-39.

LEBSOCK teaches an apparatus for testing electric motors and more particularly to a means for electrically testing and

monitoring the mechanical integrity of a gyroscope (10). See Abstract and col. 1, lines 19-21. The gyro control and monitor circuit is electrically connected to an electric motor in the form of a gyroscope spin motor simply a "gyro" (10) through a relay (12) having two sets of contacts (14) and (16) FIG. 1B controlled by a coil 18. The gyro 10 is shown including four quadrature drive windings 20, 22, 24 and a reference coil 28. The frequency of the rotational speed of the gyro spin motor is sensed by the reference coil 28 which generates a sinusoidal waveform output 30 thereacross.

LEBSOCK performs a bearing test to determine bearing wear of bearings in the gyro in the form of a spin up (See col. 5, lines 64 through col. 6, line 6) and a spin down test (see col. 5, line 31-36). Thus, LEBSOCK provides "a real time system for monitoring the wear rate and/or lubrication problems associated with a spin motor of a gyroscope." See LEBSOCK, col. 6, lines 17.

Claims 1, 7, and 14 of the present invention were amended to particularly define the sensor coil, voltmeter, and predetermined irregularity in the motor of the present invention.

More particularly, the present invention provides a device for detecting permanent magnet demagnetization in a motor in a vehicle motor in a vehicle having:

a sensor coil wrapped around a plurality of teeth in a plurality of slots of a stator of the motor adjacent to a rotor of the motor at an edge closest to a gap between the stator and the rotor of the motor, and wherein the sensor coil is not related to a plurality of windings of the motor;

a voltmeter disposed in the vehicle coupled to the sensor coil of the motor, wherein the voltmeter

periodically monitors of the state of magnetism of the permanent magnets in the motor during no load conditions to provide the detected permanent magnet induced voltage to a processor; and

a predetermined irregularity in the motor that cooperates with the sensor coil to locate a position of each of a plurality of permanent magnets in the motor.

See Present Application, Amended Claim 1, and 7; see also, Present Application FIG. 3, page 15, lines 5-16 regarding sensor coil terminology; page 14, lines 12-19 regarding voltmeter terminology; page 17, lines 7-17 regarding monitoring state of permanent magnets during a no load condition; page 18, lines 9-11, regarding strength of a magnet; and page 15, lines 18 through page 16, line 3, and page 16, lines 15 through page 17, line 6 regarding a predetermined irregularity in the motor. Additionally, the present invention provides a method of using the sensor coil, voltmeter and predetermined irregularity as shown in Amended claim 14.

Claim 2 was cancelled and the limitations of original claim 2 were incorporated into claim 1.

Claims 4, 11, and 18 were amended to replace "**a** predetermined irregularity" with "**the** predetermined irregularity" because amended claims 1, 7, and 14 respectively now provide antecedent basis for the "predetermined irregularity.

Claims 13 and 20 were amended to define the sensor coil, wherein antecedent basis for the sensor coil is now provided in claims 7 and 14, respectively.

All references to "component" are now replaced with "permanent magnet" to more particularly define the permanent

magnet as a component as shown in amended claim 1, 7, 8, 14, and 15.

In accordance with the newly added claims 21-23, the present invention limits current to the motor (30, 38) to prevent component damage (see newly added claim 21), calibrates the processor to force the motor to provide the torque required when the current to the motor is limited (see newly added claim 22), and further operates to suspend motor operation of the motor being test and switch the motive power within the vehicle to an available second motor providing an alternative motive source when a second threshold of magnetization is met (see newly added claim 23). See Pending Application, page 19, lines 3-20 and lines 19-23.

Claims 21-23 were added to more particularly define the features of the current invention that provides protective measures to the motor when demagnetization occurs including limiting current to the motor when demagnetization occurs, switching to an alternative motive power source, and providing torque to the motor when the current is limited.

The ABBOTT, HORVATH, and LEBSOCK fail to teach or suggest "a sensor coil wrapped around a plurality of teeth in a plurality of slots of a stator of the motor adjacent to a rotor of the motor at an edge closest to a gap between the stator and the rotor of the motor, and wherein the sensor coil is not related to a plurality of windings of the motor" such as the present invention. Additionally, the ABBOTT, HORVATH, and LEBSOCK references fail to teach a voltmeter built into a vehicle for monitoring permanent magnet inductive voltage and further fail to teach a pre-determined irregularity in a motor for identifying each magnet disposed within a permanent magnet motor. Also, neither the ABBOTT, HORVATH, nor LEBSOCK references provide an alternative operation of another motor

source, such as the present invention provides if the motor being tested fails each respective motor function test.

The office action, page 2, clause 3 citing ABBOTT, col. 3, ln 19-32, equates **measuring a constant voltage signal equal or proportional to the voltage across the terminals of a motor** with the permanent magnet induced voltage monitor of the present invention.

As described in the ABBOTT reference, FIGS. 1-2, and col. 3, lines 5-13, ABBOTT teaches measuring terminal voltage of a permanent magnet DC motor by supplying a constant voltage to terminals 38, 40 of the motor 20. "[S]hown in **FIG. 1** a schematic electrical block diagram of circuitry, generally designated by the numeral 10, suitable for use in testing a permanent magnet DC motor. The circuit 10 includes a constant voltage power supply 12 and a constant current power supply 14. **The constant voltage power supply provides a constant voltage, through a current sensor 16 and a constant voltage constant current switch 18, to the terminals (38, 40) of a permanent magnet DC motor 20 under test.**" FIGS. 1-2; and col. 3, lines 5-13.

However, the ABBOTT reference fails to extend the use of measuring a constant voltage across the terminals of a motor to measuring a permanent induced voltage of a motor in a vehicle using a sensor coil 210 and a voltmeter 116 of the present invention.

The testing that ABBOTT performs on motors is not performed in a vehicle, but is performed under precise conditions in a motor testing facility. Thus, the ABBOTT method of testing could not be applied in a vehicle operating in a real-world environment.

Unlike the present invention, the ABBOTT reference does not detect which magnet in the motor is failing or becoming

demagnetized but instead determines if the overall function of the motor is good or bad and rejects the motor if it fails the ABBOTT terminal voltage test. See ABBOTT Col. 4, line 5-10.

Additionally, unlike the present invention, HORVATH does not measure permanent magnet induced voltage (flux), but instead detects phase voltages of the motor (11) and tests insulation of the wire of the motor windings to determine insulation leakage in the motor.

Unlike the present invention, LEBSOCK monitors wear of a bearing in a motor and does not determine permanent magnet demagnetization by monitoring a permanent magnet induced voltage.

Applicant has amended independent claims 1, 7, and 14 to further distinguish the present invention over the apparatus disclosed in ABBOTT, HORVATH, and LEBSOCK. Additionally, the sensor coil limitations disclosed in claim 2 have been incorporated into independent claim 1.

Clearly, the apparatus and methods disclosed in the ABBOTT, LEBSOCK, and HORVATH references do not anticipate the claimed invention. Thus, the ABBOTT, LEBSOCK, and HORVATH fail to disclose, teach, or suggest a device of the present invention for Claim 1, 7, and 14 as amended clearly defining the features of detecting a specific magnet that is demagnetized in a permanent magnet motor in a vehicle.

None of the prior art references cited herein provide for altering a permanent motor to provide a current sensor wrapped around the teeth of the stator for sensing permanent magnet induced voltage coupled with a voltmeter disposed within the vehicle and to provide an irregularity in the motor to help locate each of the permanent magnets in a motor.

Additionally, the prior art references cited herein fail to identify a specific magnet that has been demagnetized or is

failing within a permanent magnet motor and to then set a diagnostic code (see claims 8 and 15), within a vehicle alerting a user of which magnet within the motor needs replacing.

Clearly, the device and methods disclosed in the ABBOTT, LEBSOCK, and HORVATH references do not anticipate the claimed invention. Thus, the ABBOTT, LEBSOCK, and HORVATH reference fails to disclose, teach, or suggest a device for detecting permanent magnet demagnetization in a motor in a vehicle using the claimed features of claims 1, 7, and 14 of the present invention.

Based on the above, it is respectfully submitted that the amended claims 1, and 3-23 are in condition for allowance, which allowance is earnestly solicited. With respect to the remaining claims, all of which depend from claims 1, 7, and 14, the fact that they claim additional elements or limitations also renders them allowable over ABBOTT, LEBSOCK, and HORVATH which allowance is earnestly solicited.

It is believed that the present invention as amended is novel and nonobvious over the reference relied upon by the Examiner.

The rejection of claims 1-20 under 35 USC § 102(b) based on anticipation is respectfully traversed. A reconsideration for allowance of these claims is respectfully requested of the Examiner.

Based on the foregoing, the Applicant respectfully submits that all of the pending claims, i.e. claims 1, and 3-23 are now in condition for allowance. Such favorable action by the Examiner at an early date is respectfully solicited.

If for some reason Applicant has not requested a sufficient extension and/or have not paid a sufficient fee for this response and/or for the extension necessary to prevent

the abandonment of this application, please consider this as a request for an extension for the required time period and/or authorization to charge our Deposit Account No. 06-1510 for any fee which may be due.

In the event that the present invention is not in a condition for allowance for any other reasons, the Examiner is respectfully invited to call the Applicant's representative at his Bloomfield Hills, Michigan office at (248) 540-4040 such that necessary action may be taken to place the application in a condition for allowance.

Respectfully submitted,

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